CAL POLY

Accelerator versus Standardizer: Cloud Strategies for the Future

ITS CLOUD PAPER SERIES
2017

Dustin DeBrum
Information Technology Services
Cal Poly

Cal Poly

Executive Summary

In the age of rapid technology advancements, organizations are looking for ways to keep their information technology services relevant. The cloud provides a path forward for many. In the following pages, we discuss the reasons Cal Poly decided to move to the cloud along with the underlying approach being employed.

Most organizations with significant IT infrastructure, whether commercial or public sector, are either migrating to the cloud or considering such a move. The rate of advancement in cloud technologies is progressing at an unprecedented pace and as such, the reasons for transitioning key inhouse IT hardware, software and services to the cloud has yet to be firmly established. Operating in a cloud environment is disruptive not only to an organization's IT staff but also to the basic financial concepts that have been in place for decades. Finance departments must now consider operational expense (OPEX) models as opposed to a capital expense (CAPEX) models. From a user perspective, however, the cloud is not disruptive but additive as it provides a more agile, responsive and innovative environment from the organization's information technology division than has been previously available. We explore two primary approaches for moving to the cloud, *standardization* and *acceleration*, with the first being supplementary to the second.

The cloud provides economies of scale that no one organization can replicate. When thousands of organizations share a common physical data center infrastructure including cooling, power distribution, physical security and facilities to house shared compute, network and storage assets, the positive cost impact is significant. Cloud providers offer technology resources on an as-needed basis with the capability of nearly infinite scaling on-demand for any size organization. With regionally diverse locations for continuity of operations in case of a regional disaster, the cloud provides the level of stability and standardization not easily achievable in the past. Whereas previously it was cost prohibitive for a small organization to implement a diverse data center infrastructure to address the needs of a rapidly growing user base, the cloud has equalized and standardized these capabilities with a pay-for-usage model. As such, the first approach to evaluate for cloud migration is *standardization* which can be seen as a *lift and shift* model in which existing services are moved from the on-premises data center to the cloud.

While standardization is a significant benefit, an equally important and more transformative impact is the *acceleration* effect. The cloud provides an organization with the opportunity to rapidly scale and explore new concepts, to implement reliable innovative solutions to customer challenges, to provide education on the most contemporary and relevant technologies, and to implement a flexible approach to future growth. Without the burden of physical infrastructure costs and traditional hardware and software r fresh cycles, organizations can now accelerate to meet the demands of rapidly changing technology.

At Cal Poly, the acceleration approach has been embraced. Instead of a direct move of services from the data center to the cloud, an evaluation of each service is being performed and optimized to take advantage of the extensive cloud services and agile environment the cloud provides. At the same time, personnel skills and training needs are being evaluated to position the staff for success in the new cloud-enabled world. The creativity unleashed by an optimized information technology infrastructure in which users can innovate without the friction of technology limitations will eliminate the barriers to student, faculty and staff success.

Paul Jurasin
Director, New Programs

Abstract

Cloud is a maturing technology without a standard approach for implementation. This results in a lack of clarity about true cost benefits and the role cloud plays in a business's technology, finance and policy plans. This paper discusses two competing strategies for cloud deployment: cloud as an accelerator versus cloud as a standardizer.

Acceleration versus Standardization

In 2011 the National Institute of Standards and Technology (NIST) drafted its seminal document to define cloud technology. Republished in 2013, the NIST Cloud Computing Standards Roadmap is often used to explain cloud in a technical style as *"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources"* [1]. The NIST roadmap document is a critical resource for cloud planning; however, its generalized approach opens the door for individual interpretation and does not address the indirect benefits cloud presents for today's business operations. The result is an absence of a universal strategic model for cloud adoption, even as we enter into the second decade of cloud technology. This lack of clarity stems from many factors including a deficit of standardized taxonomy, multiple implementation methodologies, and oversimplified generalizations and claims.

One method to break through this confusion is to define two basic approaches for cloud: standardization and acceleration. The standardization model focuses on return on investment (ROI); efficiencies and business gains are achieved from a standardized infrastructure and server deployment framework for all customers. In contrast, the acceleration model focuses on operational and technical growth, innovation, and creativity; gains will come from a self-service infrastructure and server deployment bounded by policy and process guidelines.

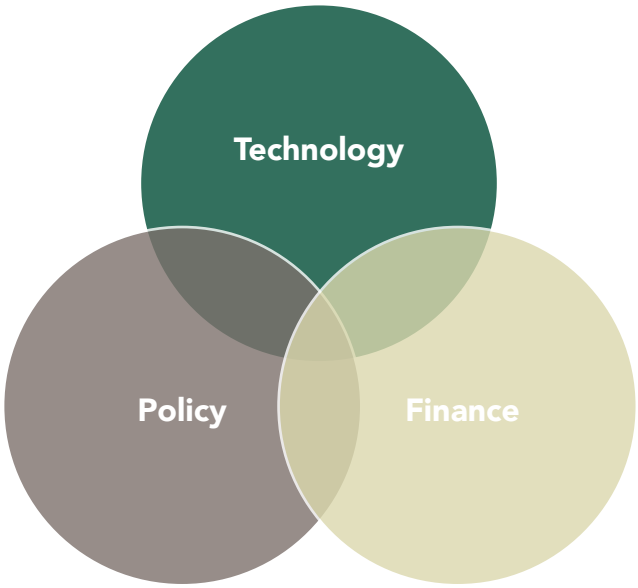
The standardization model is a familiar one, rooted in classic data center design. In this context, Operational Expense (OPEX) reduction results from standardizing hardware, software and other infrastructure costs; commonality results in net savings through standard configurations and deployments. Businesses that follow this model look to mirror existing infrastructure inside a public or private cloud provider. This model also seeks to gain efficiency by extending the standardization model through business unit resource dissemination, focusing on providing a standard platform of hardware and software configurations for services and applications to lower overall OPEX costs.

The acceleration model is based on a Lean[1] approach and provides the ability for business operations to adjust quickly and easily. In this example, OPEX savings are inherently gained by the move to cloud infrastructure and platform service models. Self-service consumption of resources based on individual business unit needs within a unified governance structure focuses on allowing units to meet their goals while lowering overall OPEX by combining variable expense savings with flexibility.

Each of these models has their positives and negatives and depending on the type of business one may be better than the other. The key contrast lies in how these two models map to today's IT

1 *"Lean project management emphasizes the power of discovery and anticipates that project schedules and deliverables must change based on the real-time learning taking place as the work is done"* [2].

realities. Applying the older private data center approach of standardization or, a *lift and shift* migration into the cloud as-is, risks missing the core benefits cloud offers: flexibility, scalability, and reliability. In the Gartner Cloud Computing Primer for 2017, analyst David M. Smith states, *"Crafting a cloud strategy is one of the top issues for our clients. Their goal is often to create a blueprint for migrating to cloud services; however, the difficulty with this type of approach is that it assumes cloud computing adoption will follow the technology adoption trends of the past. It assumes that generic decisions about which workloads should go into the cloud or how to govern cloud services in a centralized way will work in most cases"* [3].



Changing Times

The very nature of technology and how it's managed is one of change. What was once physical hardware has morphed from solid-state to digital, and now to virtualized code. At the same time, IT management has moved from departmental resource to strategic partner; CIO's are now part of the executive team and not an afterthought. Business and financial policies, which previously only considered bottom lines, now incorporate IT to ensure service continuity and security. All of this change has occurred in little more than three decades, an incredible pace when compared to the utility industries of the past. A key factor in reshaping any business is the intersection of needs, and similar to the examples of the past, the transformation of computing resources to commoditized service stems from the convergence of technology, finance, and policy[2].

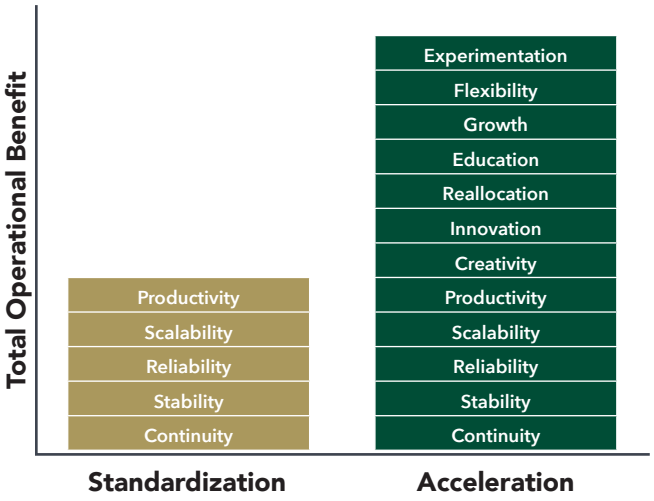
Miniaturization of hardware, efficiency gains and virtualization have all contributed to the commoditization of computing technology. From mainframes to blade servers, there has been a steady march toward standardization of computing hardware. Virtualization has been one of the largest drivers of this change. Moving from physical hardware to virtualized infrastructure provides the flexibility to use standardized equipment and resources, establishing the foundation for cloud technology and bringing about the Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) models[3].

When reviewing the financial aspects of technology, the idea that the standard building blocks of IT can be supplied as a utility requires a

2 Growing IT regulations provide additional policy impacts on cloud technology as a utility service. This has historical analogies as noted in the 2016 University of Texas at Austin white paper, History and Evolution of U.S. Electricity Industry, in which the authors stated, *"The traditional utility business model formed within the interplay of technology, finance and regulation…"* [4].

3 NIST defines these service models as the following: IaaS is, *"The capability provided to the consumer is to provision processing, storage, networks and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications."* PaaS is *"The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services and tools supported by the provider."* SaaS is *"The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email) or a program interface"* [5].

new way of thinking about the real cost benefits of doing business in the cloud. The 2013 NIST Cloud Computing Standards Roadmap highlights that right-sizing cloud resources *"…deserves careful consideration, as it relates directly to the factors that control the potential cost savings"* [6]. For most businesses, the focus here is on Total Cost of



Operation or TCO evaluation, but this misses the less tangible gains cloud brings to the table. A better approach is a simple visual that illustrates both the direct and indirect cost benefits, we can label this the total operational benefit. This view highlights the commonality between both the standardization and acceleration models as each provides a set of base benefits. The difference is in the changed mindset and flexibility to move outside a rigid structure that the acceleration model brings to bear. While these aspects do not provide an initial and easily assessed numerical value, their long-term benefit on the total operation is substantial.

What role does policy play in this interaction? Technology and finance decisions are guided by the policies that govern IT and data. Layering increasing security requirements on infrastructure, and multiple levels of data policies, directly impacts the financial bottom line. For example, consider the cost of traditional data center firewalls, which are the gatekeepers enforcing auditable policies and rules for the data traffic on a network and which require scaling and responsive load-balancing to meet the needs of the organization. These physical devices are expensive and need cyclical replacement that requires budgeting of time and resources. In a cloud model, you can replace physical firewalls with an IaaS service that is adaptable to the organizational needs and swaps regular purchasing cycles and implementation time for an automated and continually improved service.

The confluence of technology, finance and policy is what has led Cal Poly to move to a DevOps[4] methodology by applying systems thinking[5], focusing on the interactions of formerly disparate operational areas and identifying cloud technology as the logical next step for the university's future growth.

Flexible Growth

Cal Poly's current physical data center resides under a leaky second-floor restroom within an aging building, virtually unchanged since it was built in 1963. It spans 3,000 square feet supporting over 900 virtual machines spread across 78 racks of hardware and serving the data application needs

4 *"DevOps is a cultural movement that changes how individuals think about their work, values the diversity of work done, supports intentional processes that accelerate the rate by which businesses realize value, and measures the effect of social and technical change. It is a way of thinking and a way of working that enables individuals and organizations to develop and maintain sustainable work practices. It is a cultural framework for sharing stories and developing empathy, enabling people and teams to practice their crafts in effective and lasting ways"* [7].

5 Systems thinking is: *"appreciating and understanding the interdependent nature of the parts of business systems and how they interact with their environment and influence each other. The focus is on the interactions between the Dev and Ops groups and its impact on the uninterrupted flow of value from concept, to development, to release, to service, to maintenance, to upgrade, and eventually to retirement"* [8].

Cal Poly

of over 25,000 students, staff and faculty. *"We are literally one flush away from losing all of our data"* [9] has been the rallying cry of Bill Britton, Cal Poly vice president of Information Technology and CIO, as he has sought to improve reliability and reduce risk to the campus information infrastructure. Keeping this aging facility operational has meant using everything from duct tape to garden hoses. According to Britton, *"They've tried to leak-proof that room so many times it's impossible. It's a 1960s building. It's going to leak"* [10]. Like many universities, Cal Poly has adapted to changing economics and funding gaps with deferred maintenance and infrastructure investment. Deferment can only go so far, however, and Cal Poly is at crossroads—replace the existing data center with a new physical data center on-site or leverage the cloud.

Estimates for a new modern data center facility, with the capacity to adapt to the university's growing needs, range between $8 million to $10 million. These do not include the addition of teaching and learning facilities, staff space, and other long-term elements crucial to the school's mission. So—how does a polytechnic university create learning opportunities for modern data center management while maintaining flexibility and scalability for growing computational and data management needs? For Cal Poly, the solution is in the accelerator model with an all-in cloud deployment.

The Cal Poly Approach

Nicolas G. Carr noted in his Harvard Business Review article IT Doesn't Matter, *"When a resource becomes essential to competition but inconsequential to strategy, the risks it creates become more important than the advantages it provides"* [11]. Carr's point is the view Cal Poly has taken of the university's IT infrastructure and why it has gone all-in with transformative cloud solution. The outdated model of an all-encompassing data center creates more risk than advantage in today's business environment. As a result, 80 percent of the campus IT infrastructure and services will migrate to the cloud, including core applications such as the campus learning management systems (LMS), database services, mobile applications, data warehouse, content management services, security applications, student scheduling and advising services, among others. The remaining 20 percent will include onpremises infrastructure required for campus operations plus data center hardware

utilized for teaching and learning. Cal Poly will combine this approach with a *cloud first* evaluation for all future applications and services, focusing on their SaaS capabilities (e.g., Is the application vendor-hosted or can it be cloud hosted?) to ensure the flexibility of the remaining on-site infrastructure and how IT services can support student success.

It is important to point out that this is not a *lift and shift* approach; the existing physical data center will not be directly migrated to a virtual one. The acceleration model that Cal Poly has chosen is more flexible to the current and future needs of campus customers and far more adaptable to the transforming technology needs of higher education. It will give researchers the ability to quickly spin-up resources to facilitate projects, support big data analytics, reduce calculation times, and focus limited research dollars on actual compute usage instead of hardware overhead (much of which can go unused). Adopting templates based on policies and automated procedures will allow customers to rapidly build, deploy and tear down systems without the historical overhead of stringent implementation specifications and traditionally slow request and delivery workflows. It will provide guardrails around spaces open for safe and secure experimentation and support teaching and learning initiatives. This open canvas approach is designed to foster creativity and innovation rather than stifle it.

Cal Poly's innovative approach started with the idea that identifying a partner—not just a service provider—is paramount for a successful migration to the cloud. By choosing Amazon Web Services (AWS), Cal Poly has found a counterpart that can provide functionality, fast-pace innovation, a broad ecosystem of services, customers and external partners, all with a proven operating and security expertise. This mix of service and partnership will aid Cal Poly in providing a best-in-class student experience by supplying a flexible infrastructure to support teaching and learning, scalable cost-effective resources to grow research capabilities, and tools to educate a twenty-first century workforce.

Support for Transformation

The Cal Poly Digital Transformation Hub powered by AWS (DTHub) is an important part of the unique partnership established between AWS and Cal Poly. The DTHub is a new concept that will help public sector entities find technologically advanced solutions to solve their challenges while at the same time exposing students and faculty to developing real world cloud technology strategies and solutions. In a recent Cal Poly press release for the AWS partnership, Teresa Carlson, vice president, Worldwide Public Sector at AWS said, *"We're so pleased that Cal Poly raised the bar by not only moving its infrastructure to the cloud but also working with AWS to launch the Cal Poly Digital Transformation Hub, giving an opportunity for its students to also use cloud technology and have an even broader impact on citizens. This is a great example of how technology can act as a catalyst to help make the world a better place"* [12]. In the same announcement Cal Poly President Jeffrey D. Armstrong concurred, stating, *"Cal Poly's motto is Learn by Doing, and as an institution focused on technology, what better way to embody that than by transforming our own IT infrastructure and going all-in with the world's leading cloud provider, AWS"* [13]?

The decision to move to the cloud was not a fast one but rather a process; Cal Poly took two years to evaluate both current and future needs of its technology portfolio. Embracing Carr's lesson of risk versus advantage, this included identifying how the public cloud could mitigate risk while providing a net positive financial benefit. Cal Poly had been reviewing the possibility of building out a new data center with an estimated base cost of $8 million, and that number could have soared past $20 million when factoring in heating, cooling, electricity and data back-up and recovery. It is these same costs that are increasingly motivating private companies to move to the public cloud, and many government agencies are following suit

at both the federal and state level. Said Bill Britton, *"One of AWS's best customers is the CIA. And they were moving to the cloud. And our question was, 'If they could do it, why not a university? Why not us'"* [14]?

Summary

As first asserted, cloud adoption lacks a standardized deployment strategy, but building on the strategic foundation of cloud technology as an accelerator for change is the fundamental starting point for addressing this problem. Continued effective change is needed to maintain flexibility, scalability and reliability; these key fundamentals of the cloud accelerator model open new opportunities for innovative collaborative growth. Removing the rigid structures of fixed, overly defined architecture and creating instead an open model, encircled with policy and process guardrails, eliminates the barriers that can inhibit creativity. As a fundamental part of any business, it is creativity that gives teams the ability to reframe how they see the challenges before them, to make those continuous small-steps in support of their strategic objectives, and better support the changing needs of the customer.

Cal Poly

References

[1] Hogan, Michael D. & Sokol, Annie W. (2013, July). NIST Cloud Computing Standards Roadmap – NIST Special Publication 500-291 Version 2. pp. 2. Retrieved from https://www.nist.gov/publications/nist-cloud-computing-standards-roadmap

[2] Orzen, Michael A. & Paider, Thomas A. (2016). The Lean IT Field Guide: A Roadmap for Your Transformation. Boca Raton, Florida, USA: CRC Press – Taylor & Francis Group. pp. 9.

[3] Smith, David M. (2017, January). Cloud Computing Primer for 2017. pp. 3. Retrieved from https://www.gartner.com/doc/3570517cloud-computing-primer-

[4] Andrade, Jason A., & Baldick, Ross & Duncan, Roger & King, Carey W. & Hebner, Robert & Gulen, Gurcan & Tuttle, David P. & Spence, David B. (2016, July). History and Evolution of U.S. Electricity Industry. pp. 3. Retrieved from https://energy.utexas.edu/files/2016/09/UTAustin_FCe_History_2016.pdf

[5] Hogan, Michael D. & Sokol, Annie W. (2013, July). NIST Cloud Computing Standards Roadmap – NIST Special Publication 500-291 Version 2. pp. 9. Retrieved from https://www.nist.gov/publications/nist-cloud-computing-standards-roadmap

[6] Hogan, Michael D. & Sokol, Annie W. (2013, July). NIST Cloud Computing Standards Roadmap – NIST Special Publication 500-291 Version 2. pp. 48. Retrieved from https://www.nist.gov/publications/nist-cloud-computing-standards-roadmap

[7] Daniels, Katherine & Davis, Jennifer (2016). Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale. Sebastopol, California, USA: O'Reilly. pp. 13.

[8] Orzen, Michael A. & Paider, Thomas A. (2016). The Lean IT Field Guide: A Roadmap for Your Transformation. Boca Raton, Florida, USA: CRC Press – Taylor & Francis Group. pp. 7.

[9] Lazier, Matt (2017, June). Cal Poly Goes All-In on AWS. Retrieved from http://calpolynews.calpoly.edu/news_releases/2017/June/Amazon.html

[10] Lazier, Matt (2017, June). Cal Poly Goes All-In on AWS. Retrieved from http://calpolynews.calpoly.edu/news_releases/2017/June/Amazon.html

[11] Karr, Nicholas G. (2003, May). IT Doesn't Matter. Harvard Business Review. sec. Offence to Defense, para. 1. Retrieved from https://hbr.org/2003/05/it-doesntmatter

[12] Lazier, Matt (2017, June). Cal Poly Goes All-In on AWS. Retrieved from http://calpolynews.calpoly.edu/news_releases/2017/June/Amazon.html

[13] Lazier, Matt (2017, June). Cal Poly Goes All-In on AWS. Retrieved from http://calpolynews.calpoly.edu/news_releases/2017/June/Amazon.html

[14] Lazier, Matt (2017, June). Cal Poly Goes All-In on AWS. Retrieved from http://calpolynews.calpoly.edu/news_releases/2017/June/Amazon.html